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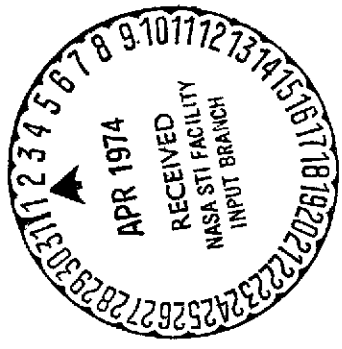

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The Soviet Soyuz-13 spacecraft recently completed its 8-day flight and brought back to earth material on the scientific research carried out during the flight by its crew--cosmonauts P. Klimuk and V. Lebedev. Although the detailed processing of all the results obtained has not yet been completed, the preliminary results of the flight may already be summed up.

How does Soyuz-13 differ from its predecessors? Above all, the craft's appearance was determined by its chief task: Soyuz-13 is an orbiting astrophysical observatory whose personnel, if it may be put like that, work not on earth but outside the earth atmosphere which excludes the possibility of making observations on certain waveleng .s.

But the housing of astronomical instruments on board spacecraft and space stations enables the influence of the atmosphere to be virtually completely excluded and qualitatively new information to be obtained--information needed to ascertain the characteristics and nature of processes taking place on heavenly bodies and to verify hypotheses on their origin and evolution.

The research carried out in 1971 by the crew of the Salyut-1 station with the help of the "Orion-1" stellar telescope and a gamma telescope installed on board gave the first results and fully confirmed the correctness of the methods selected for extra-atmospheric astronomy and of the scheme for implementing them.

The "Orion-2" complex of apparatus was installed on the Soyuz-13 craft to carry out astrophysical research, and its task was to obtain pictures of the spectrums (spectrograms) of starts in the ultraviolet sphere. The telescope of the "Orion-2" system with a photographic attachment was installed on the outside of the orbital section, at the position of the docking assembly which some craft of the "Soyuz" series have.

The "Orion-2" apparatus has a protective canopy to insure a normal temperature regime, protecting the telescope from overheating on the sunny side of the orbit and from supercooling on the shady side. Opposite the telescope's lens there is a "window" in the canopy with a bivalve cover, which opens only for the duration of an experiment.

The telescope was trained on a prescribed section of the sky in the following manner: first, the commander of the crew, using the manual guidance system and the system's gyroscopes, oriented the craft as accurately as possible so that the optical axis of the immovable telescope was directed toward a sufficiently bright reference star.

The reference star itself serves only as an orienting point to keep the telescope trained on the prescribed region of the sky which contains the start whose spectrograms are of interest.

Then, with the help of an optical sight linked to the telescope by a remote servosystem, the ship engineer, situated in the orbital section, trained the telescope more accurately on the reference star by turning the telescope relative to the hull of the space apparatus. Then he switched on the automatic servosystem, which performs the final guiding and stabilizing of the telescope in the direction of the star with an accuracy of up to a few angular seconds.

In order to prevent the telescope's rotation on its optical axis (this leads to "blurring" of the image on the photographs) the telescope's stabilization is carried out in relation not only to the chief reference star but also to a second one situated at a large angle to the first one.

The spectrograms of emission from stars in the chosen section of the sky obtained with the help of the stellar telescope were recorded on special high-sensitivity film, and each section of the sky was photographed with exposures varying between one and 20 minutes, which enabled spectrograms of a large number of bright and weak stars to be obtained simultaneously on each photograph.

During the flight the crew held 16 spectrophotography sessions to record the emission of stars in various sections of the sky, and they fulfilled the planned program. An examination by astronomers of the photographs of the sky shows that the cosmonauts succeeded in obtaining very rich material--spectrograms of several thousand stars were recorded (the total number of spectrograms is of the order of 10,000). And in individual cases the emission from very remote luminaries--up to 12th stellar magnitude and weaker!--was recorded. This is the first time that photographs in the ultraviolet band of the spectrum have been taken of such weak stars. This proves the very promising nature of the method used for studying stellar spectrums.

The scientific program of the Soyuz-13 craft was not limited just to questions of astrophysics. An experiment in photographing the earth's surface in different sections of the solar spectrum was also carried out from on board. The survey was made with a special multilens camera. Here each section of the earth's surface under study was photographed simultaneously in nine spectral zones from the visible to the near infrared with the use of light filters. Study of the photographs obtained will enable a more precise selection to be made of zones of the spectrum, photographic materials, and exposure times most suitable for resolving particular tasks.

In addition to this, during the flight the cosmonauts photographed natural formations of the earth's surface on the crepuscular and daytime horizon of the earth with the help of a manual spectrograph. Photographs of this sort of the cosmic dawn enable us to judge the dust content in the atmosphere and its optical properties.

Medical-biological research was carried out in accordance with a program of scientific experiments. Among them one may point to a study of the nature of the redistribution of blood in the human organism during spaceflight. Because of the lack of hydrostatic pressure in weightlessness blood flows away from the feet and toward the upper part of the body--toward the head, in particular.

This may cause deterioration in the cosmonauts' state of health in the first days in orbit. The reaction mechanism and adaptive abilities of the brain's blood circulation system were studied with the help of the "Levkoy" apparatus with the cosmonauts at rest and after performing measured exercises [dozirovannyye nagruzki].

The influence of spaceflight factors on the development of lower plants (chlorella and duckweed) was studied on board the Soyuz-13 craft. A study was also made of special features of the development of two types of micro-organisms (hydrogenous bacteria and urobacteria) under weightless conditions and of the generation of a protein mass as a result of the experiment for subsequent analysis of its biochemical composition. The experiment was carried out with the help of the "Oazis-2" system.

The special nature of this experiment lies in the fact that the nutrition and reproduction of the bacteria and the formation of the protein mass took place in a system with a closed volume, in a closed cycle, with mutual enrichment of the two types of bacteria as a result of the synthesis of certain substances and the secretion of others.

"Oazis-2" is to some extent a prototype--although still very distant and miniature--of future life-support systems for spacecraft which will set out at some time on long voyages on which the reprocessing and further utilization of all the metabolism's waste products will be required.

The data from the experiment are now being processed, but first results have already shown that the biomass of the microbe culture in the "Oazis-2" system increased more than 35 times during the flight.

In addition to scientific research, the crew of Soyuz-13 performed a number of technical experiments whose aim was to develop new instruments for their further use in improved onboard systems.

The craft's onboard systems, units, and mechanisms worked normally throughout the flight. The USSR pilot-cosmonauts and Heroes of the Soviet Union--crew commander Petr Ilich Klimuk and ship engineer Valentin Vitalyevich Lebedev--coped excellently with the tasks set them and fulfilled during the flight a large volume of work in carrying out research and controlling the craft. One should particularly point to their coordinated and skillful work in making astrophysical observations with the telescope. The flight of Soyuz-13 has made a significant contribution to the development of space research.